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International Symposium on Astronomical Telescopes and Instrumentation
Session on Radio Telescopes
Chair: Harvey R. Butcher

Abstract Title: Opto-Mechanical Design of the Ultralightweight FIRST Telescope

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Presentation; Oral Presentation

Abstract: The FIRST telescope will be made of carbon fiber reinforced plastic. The optics follow a two mirror near-classical Ritchey-Chretien design, but deviates from that in two respects. The secondary mirror defines the pupil of the system, and the primary mirror is uncommonly fast at f/0.5. After presenting the optical design and the sensitivities the opto-mechanical design will be described.

Considerations in the opto-mechanical design are the launch loads, the thermal noise background that limit the photoconductor (PACS) and bolometer (SPIRE) instruments, avoidance of the sun at a 30° tilt angle towards the sun, and preventing thermal effects from causing mirror distortion. This paper will discuss how these considerations impact the:
1 - design of the tripod that supports the secondary
2 - secondary mirror material, edge design and scatter cone
3 - primary mirror hole size, through-the-thickness, shape and baffling
4 - mount and flexure design for both mirrors

As part of the design, all components were toleranced, and the residual errors and potential perturbations were determined. The methodology of predicting potential perturbations (1) between ambient test and cryogenic test, and (2) between cryogenic test and spaceborne service is described, and the implications for actuating the secondary mirror in various degrees of freedom is discussed. The resulting error budgets, under various scenarios, are summarized.

Key Words: Telescopes, Ultralightweight, Composites

Biography; Dr. Eri J. Cohen Received his BS from Brooklyn College in 1965, his MS and Ph.D. from Harvard in 1971 and did three years of Post Doctoral work at the California Institute of Technology. He Joined the NASA-Jet Propulsion Laboratory in 1974, where he has worked in the areas of VLBI instrumentation and telescope development. He is currently the System Architect for the FIRST Telescope.